Emergency Move to Remote Teaching: A Mixed-Method Approach to Understand Faculty Perceptions and Instructional Practices

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ABSTRACT
This study focuses on the recent emergency move from face-to-face to remote teaching in higher education due to the coronavirus disease pandemic (COVID-19). This mixed-method study uses data collected from an anonymous online survey as well as case study interviews. We aim to examine how this novel phenomenon affected the perceptions and teaching experiences among faculty members who previously taught courses on campus and then suddenly switched to remote delivery of their courses during Spring 2020. Specifically, we explore how faculty adapted their instruction quickly during the semester and how they perceived the emergency transition to remote delivery. Our findings suggest that the extent to which faculty perceived remote teaching as easy or satisfying is closely associated with their degree of adjustment, their level of comfort with remote teaching, and whether their course was suitable for online instruction. Additionally, faculty reported benefiting more from resources for remote teaching provided within their college, compared to other university-wide resources. The study concludes by drawing some inferences about important factors that higher education institutions need to consider to effectively support faculty’s varying needs and instructional practices in an online environment.

Introduction
The coronavirus disease (COVID-19) pandemic has affected higher education significantly (Marinoni, Van’t Land, & Jensen, 2020; Pokhrel & Chhetri, 2021). In March 2020, colleges and universities around the world switched quickly from face-to-face courses to remote delivery in response to this unprecedented health emergency. Our mixed-method study explores how this switch affected the perceptions and teaching experiences among faculty members who were forced to move to remote delivery of their courses during the Spring 2020 semester. Based on both quantitative and qualitative findings, the study draws some inferences about important factors that influenced the extent to which faculty perceived emergency remote teaching as positive or negative. Our study provides useful implications on how institutions can effectively support faculty instructional practices in future emergency remote teaching situations.
Comparison between face-to-face and online teaching

In the last two decades, researchers have investigated the differences and similarities between face-to-face and online modes of instruction (Ferguson & Tryjankowski, 2009; Tutty & Klein, 2008). Bennett and Lockyer (2004) suggested that a move to an online mode entails changes to both pedagogy and practice, which leads to an expansion of the range and scope of online instructors’ teaching responsibilities (e.g., required technical skills, communication strategies). Contrary to on-campus teaching, almost every aspect of online teaching is dependent on technology, thus the availability of well-designed tools and support from the institution becomes critical in an online environment. Redmond (2011) explored the paths for two instructors who moved their classes from face-to-face to blended and eventually online teaching. The study suggested that online instructors are expected to work closely with the institution and peer instructors to seek resources and share knowledge regarding new pedagogical practices to engage students in the new online environment.

While there are notable differences between traditional in-person and online modes of instruction, some studies have found common instructional factors that are considered essential to facilitate students’ successful learning in both teaching modes. Based on findings from a mixed-method study on two courses with the same instructor and course content that differed only in course delivery mode (i.e., face-to-face versus online), Hurlbut (2018) found that, for both types of courses, “instructor presence, interaction, and feedback” contributed most to enhancing students’ learning performance (p. 263). The importance of instructor feedback is consistent with Moore’s (1993) theory of transactional distance, which posits that instructor feedback through formative and/or spontaneous assessments is critical to decreasing the transactional distance – psychological or communicative space between the instructor and students in a distant learning environment – and supporting students’ autonomous learning.

Perspectives on conceptualizing emergency remote teaching

On the other hand, researchers have pointed out that emergency remote teaching should be considered different from online-by-design teaching. Traditional online course design for a typical semester-long course, which adopts asynchronous methods to deliver instruction, generally requires at least 6 months of collaborative work between faculty and instructional designers (Ray, 2009). Also, the typical process of planning for an online course involves multiple stakeholders in setting up a safe environment for various learners, optimizing learners’ accessibility and time required to spend on online tasks, and creating a collaborative learning environment (Hoffmann & Dudjak, 2012; Ray, 2009; Wolf, 2006).

In contrast, with respect to the recent emergency move to remote teaching, instructors were required to quickly prepare for and adapt their classes to an online mode. Researchers have echoed the importance of viewing emergency remote teaching as a temporary solution to provide students with access to instruction and course materials as quickly and reliably as possible (Bozkurt & Sharma, 2020; Hodges, Moore, Lockee, Trust, & Bond, 2020). Moreover, a majority of these instructors had no or limited prior experience with teaching in a virtual environment. Taking these perspectives into consideration, Whittle, Tiwari,
Yan, and Williams (2020) provide a conceptual framework for understanding the emergency remote teaching environment (ERTE) to provide practical guidance on how to develop and evaluate ERTEs in future crisis situations.

**Impact of the transition to remote teaching on instructional practices**

Since the pandemic began, a growing body of research has examined how the transition to remote teaching has impacted instructional practices in higher education. For example, a group of researchers conducted a survey study to examine how faculty across 672 institutions in the US have adapted their courses during the early weeks of the pandemic (Johnson, Veletsianos, & Seaman, 2020). The results showed that most faculty utilized synchronous video lectures and adjusted various instructional practices such as grading, assignments, and students’ workload. But challenges include adapting to new technology, creating interactive class materials, arranging collaborative projects and assessments in an online environment, and dealing with mental health issues and pressures (Kessler et al., 2020; Safi, Wenzel, & Spalding, 2020; Tsai et al., 2020).

Researchers have also assessed the emergency transition from the institutional perspective. Kessler et al. (2020) stressed that the role of organizational structures – that is, the extent to which units and departments within an institution are poised to cooperate can enhance their confidence in preparing for future emergency transitions. Likewise, Johnson et al. (2020) suggest that institutions should provide faculty with ample opportunities to participate in online professional development workshops or webinars. Our study explores what types of resources faculty sought actively and which they perceived as most beneficial.

**Research questions**

To add to this growing body of literature, our study captures in-depth faculty experiences and perceptions within the context of a technology-focused public university in the US. This study is guided by three research questions. First, in what ways did faculty adapt their instruction for emergency remote teaching? Second, how did faculty perceive their transition to remote teaching? Finally, what were the primary issues faculty faced with remote delivery, and what are the lessons they have learned?

**Method**

**Participants and settings**

All faculty members who were teaching during Spring 2020 at a public university in a southern state of the US were invited to participate in an anonymous online survey. The survey was open between the mid- and end of April, near the end of the semester. Of the 1,407 faculty members to whom an e-mail invitation was sent, 266 responded to the online survey, indicating a response rate of 19%. By using a pairwise deletion technique for handling partially completed survey data (Roth, 1994), we deleted only 17 cases (6% of total submissions) that contained missing values in relation to items that required statistical analyses. As a result, our final sample comprised of 249 participants.
Among total participants, 53% were tenure-track and 47% were non-tenure-track academic faculty. Regarding college teaching experience, 43% reported having zero to 10 years of prior experience; 27% indicated having between 11 and 20 years of experience; and the remaining 30% reported 20 or more years of experience. By college affiliation, 34% were employed in the College of Engineering, followed by 27% in Sciences, 19% in Liberal Arts, 8% in Business, 7% in Computing, and 4% in the College of Design. On average, participants were teaching two courses with approximately 60 students in their classes. For the case study, seven faculty members, three non-tenure-track and four tenure-track, participated during May 2020 after the Spring semester concluded. Three participants were from the College of Design, two from the College of Engineering, and another two from the College of Sciences. Teaching experience at the institution ranged from 2 to 34 years. Appendix A provides specific demographic information of the case study participants.

**Procedure and data sources**

This study used a mixed-method approach, with quantitative data coming from participant responses to survey items as well as qualitative data from case study interviews. We adopted an explanatory sequential design (Creswell & Clark, 2018) in which quantitative survey data were initially collected and analyzed (Phase 1), and then qualitative follow-up research was conducted to help explain the quantitative results (Phase 2). By using a two-phase approach, we were able to use rich qualitative data to extend and complement the snapshot of faculty’s emergency remote teaching experience captured through the quantitative data.

To recruit participants for the anonymous online survey, the researchers worked with the Office of Provost to distribute a Qualtrics survey link through the all-faculty e-mail listserv. Interested faculty were asked to review an electronic consent form and indicate whether they agreed to participate. The estimated time to complete the survey was less than 20 minutes. Respondents were allowed to skip questions. For the case study, we used a stratified sampling method that entailed reaching out to the Dean’s Office of the six colleges at the institution and asking for recommendations of two or three faculty members with varying degrees of online teaching experience. To maximize the chance of recruitment, the researchers also used a snowball sampling technique in which participants help recruit other eligible participants. Participants, who had reviewed the electronic consent form and agreed to participate in the study voluntarily, were asked to take part in a virtual interview session which typically lasted for about 30 minutes. During the interview session, member checking (e.g., restating participants’ responses or asking questions to ensure accuracy of information) was conducted to improve the validity of qualitative findings.

**Measures**

Prior to administering the survey, the researchers reviewed the survey items with a panel of experts including a senior faculty member, digital learning expert, and communications manager to ensure face validity. The finalized survey consists of a total of 20 questions with 18 closed-ended and 2 open-ended items. The open-ended questions asked the respondents to report any instructional activities they have used to support student remote learning. Given the current study’s focus on faculty attitudes and perceptions, we mainly analyzed the closed-ended questions, which asked participants about demographic information,
perceptions about their online transition experience, instructional adjustments and challenges, and helpfulness of resources for remote teaching. Our measures of faculty perceptions included: the degree of adjustment they made to their instruction, suitability of course subject to online mode, and their level of comfort, satisfaction, and perceived difficulty with remote teaching (see Table 1 for descriptive statistics).

For the case study, the researchers used semi-structured interviews to collect data. The researchers scheduled a series of virtual one-on-one interview sessions where they took notes and audio-recorded each conversation. The interview questions were designed to solicit feedback and input about the faculty’s teaching background (2 questions), current courses (3 questions), and transition to remote teaching (5 questions).

**Data analysis**

To analyze quantitative data from the online survey, we used descriptive statistics, including the distribution of closed-ended responses (e.g., frequencies, percentages). We used IBM SPSS (version 25) to conduct correlation and inferential statistics analyses to determine associations among variables. For data from the case study interview transcripts, we conducted a systematic investigation using established qualitative data analysis methods. Guided by Yin’s (2003) framework, the analysis focused on exploring the impact of the phenomenon (i.e., emergency remote teaching) on faculty within and across cases. Furthermore, our qualitative coding process involved a constant comparison analysis to generate broad themes of the collected information (Creswell & Gutterman, 2019). The research team began the analysis by creating initial codes, followed by making detailed descriptions of each case and its setting. Then, we expanded and revised the codes through an iterative process of carefully describing, comparing, classifying, and interpreting codes and their corresponding themes that emerged across cases.

**Results**

**Instructional adjustments for remote teaching**

In the first research question, we sought to examine how much flexibility faculty demonstrated while adapting to emergency remote teaching. Regarding the primary methods used to deliver instruction after the emergency transition, approximately half of survey respondents (45%) reported using a combination of asynchronous (e.g., prerecorded lecture

| Table 1. Mean and standard deviation of the transitioning perception scale (n = 249) |
|---------------------------------|------------------|-----------------|------------------|------------------|------------------|
| Adjustment | 0 = none, 1 = a little, 2 = a moderate amount, 3 = a lot, 4 = a great deal | 2.82 | .96 |
| Suitability | 0 = not well at all, 1 = slightly well, 2 = moderately well, 3 = very well, 4 = extremely well | 1.95 | 1.15 |
| Comfort | 1 = very uncomfortable, 2 = uncomfortable, 3 = neutral, 4 = comfortable, 5 = very comfortable | 3.87 | .83 |
| Satisfaction | 1 = very dissatisfied, 2 = dissatisfied, 3 = neutral, 4 = satisfied, 5 = very satisfied | 3.60 | .76 |
| Perceived Difficulty | 1 = very easy, 2 = easy 3 = neutral, 4 = difficult, 5 = very difficult | 3.15 | 1.06 |

1While the areas of adjustment, suitability, and perceived difficulty were each measured by one question, the areas of comfort and satisfaction each included several sub-scales (see Figure 2). The mean score for each of these two areas indicates a composite score based on the average of the corresponding sub-scales. Cronbach’s coefficient alpha value for the comfort scale was .77 and that for the satisfaction scale was .83, indicating acceptable levels of internal reliability.
videos) and synchronous methods (e.g., live video sessions). Another 33% relied solely on synchronous methods while the remaining 18% delivered their instruction asynchronously. Interestingly, the types of delivery methods that the faculty adopted appeared to differ by college (see Figure 1). Further, given our study context (i.e., a technology-focused institution), we were interested in comparing broadly between STEM colleges (science, technology, engineering, and mathematics) and non-STEM colleges regarding whether there is any difference in the trends for adopting certain methods. The results of a chi-square test of independence indicated that faculty from non-STEM colleges were more likely to report using asynchronous methods (28% among non-STEM respondents) than those from the STEM colleges (14% among STEM respondents), $\chi^2 (1, N = 244) = 7.33, p < .01.$

The next set of questions asked participants about how they adapted their instructional practices, including those for communication, assignments, and grading. First, participants were asked to choose any tools they used to communicate with their students during the remote course delivery. Of 631 total responses, e-mail (32%) and virtual web-conferencing tools (e.g., BlueJeans, Microsoft Teams) (33%) were the most frequently reported tools. Additional tools included discussion boards (15%), real-time chat (8%), and other methods (e.g., 12%). In terms of adapting assignments and exams, respondents commonly reported using various assessment tools available in the Canvas learning management system. This accounted for 65% of 310 total responses. We observed relatively lower usage of Learning Tools Interoperability (LTI) applications, which can be integrated with the Canvas platform (11% of total). Some examples of such LTI tools included those designed to help instructors digitize and grade paper-based assessments (e.g., Respondus 4.0, GradeScope). Other methods (the remaining 24%) included having open-book exams or using video production tools in place of live presentations. Regarding how faculty adapted their grading of student participation, respondents frequently reported reducing participation requirements (31% of total). Other commonly used methods included relying on information from prior class meetings (23%), giving students alternative assignments such as reflection essays (21%), adding discussion boards (14%), and using a virtual tool to check attendance (11%).

![Figure 1. Comparison of the primary methods used by different colleges to deliver instruction.](image-url)
Similarly, our case study results showed that participants adapted two main aspects of their courses: course design and instructional technology. First, in terms of course design, all participants mentioned that they adjusted the coverage of course content, types of assignments, and methods of assessment to some extent. Some participants re-configured projects to handle logistical difficulties; for example, by switching in-person projects (e.g., user testing) to computer modeling projects in an industrial design studio course (Participant 4). Other participants reported that they often reduced teamwork requirements. For instance, Participant 5 mentioned that he did not have time for students to do live group presentations and therefore had to adapt by having individual students create a 5- to 7-minute video instead. Also, many participants reduced expectations around exams and rather placed an emphasis more on mastery of content materials by allowing students re-take quizzes or resubmit assignments (e.g., Participant 1: “I give them multiple chances and they get the higher grade on it because I just want them to learn”).

Regarding instructional technology, many participants reported that they spent a great deal of time searching for technology tools or experimenting with various tools to ensure that students had a seamless transition to remote learning. Several participants utilized tablet devices (e.g., iPad with Apple Pencil) as an alternative tool for a whiteboard, which allowed them to easily write and display complex information such as mathematical equations. Also, some participants appeared to benefit from support from peer faculty members. On the other hand, Participant 5, a senior faculty member who has more than 30 years of teaching experience at the institution, proactively reached out to his colleagues to provide them with helpful resources about technology. He mentioned that “I ran a session for all our faculty on a Zoom event to get them to see what that was like . . . a lively hour session.”

**Faculty’s perceptions about the emergency move to remote teaching**

The second research question pertained to measuring faculty’s general perceptions about the emergency move. First, we examined faculty respondents’ perceptions in the areas of adjustment, difficulty, suitability, comfort and satisfaction. As Table 1 shows, the participants on average reported making somewhere in between a moderate amount and a lot of adjustments in their instruction. Regarding perceived difficulty of switching from face-to-face classroom activities to online, nearly 40% of total respondents rated their transitioning experiences as difficult or very difficult. Moreover, the respondents on average tended to perceive their course subjects as only moderately suitable for online instruction. Only 29% of respondents perceived their course subjects as very or extremely suitable for online instruction. As reported in Figure 2, when asked to rate their specific teaching activities after the transition, participants reported the lowest levels of comfort toward engaging students in discussions with online forums or chat rooms. Also, they were least satisfied with the activity of assessing students’ learning and progress.

Next, we examined bivariate correlations among faculty perception variables and instructor characteristics. The degree of adjustment was positively correlated with perceived difficulty and negatively correlated with perceived suitability, comfort, and satisfaction. Moderately positive correlations were observed among suitability, satisfaction, and comfort.
Both the number of classes that faculty taught and the maximum number of students in the class had a positive correlation with adjustment. The number of classes also had a positive correlation with perceived difficulty (see Appendix B).

Additionally, based on the survey findings, we were interested in exploring factors that might contribute to differences in attitudes toward their remote teaching experiences. Through our analysis of the transcript data, three important factors emerged. First, even though all participants actively sought feedback on how the class was going from their students, there were notable differences in how they viewed their students and therefore what expectations to set for remote teaching and learning. Specifically, some participants showed more empathetic views toward students regarding their struggles amid the pandemic, whereas others placed more emphasis on self-discipline or holding students accountable for their own learning. Those who expressed empathy generally understood that many students were facing difficulties that virtual learning poses as well as difficult circumstances at home. But several participants noted that some students struggled in the remote mode because they had a lack of “discipline” (Participant 1) or were having a hard time managing
their schedules without the structure of campus life and classes. According to Participant 5, some students were just “putting things off until just before the exam,” which made him feel worried. Participant 7 emphasized that it is important for students to have a sense of obligation, by noting that “one motivation to keep students moving . . . is their commitment.”

Next, the participants’ attitudes toward remote teaching appeared to be influenced by their prior experience with technology. Participants who had more experience in teaching, learning, or having professional meetings online seemed to have a generally positive stance toward technology and were more enthusiastic about the transition, although they still ran into difficulties transitioning to remote teaching (see Appendix C for exemplary quotes). Participant 4, who had no prior online teaching experience, felt her subject area (design) was “hands-on” and thus ill-suited for online delivery, leading her to build negative feelings toward remote teaching.

Finally, we observed that the home environments and professional history of individual participants might have influenced the way they prepared for and implemented the shift to virtual classes. Some participants had children at home or unreliable internet that made teaching virtually more difficult, and therefore needed more help. As an example, Participant 2 brought up the difficulty of achieving a balance between work and family. She commented that “It’s just juggling the homework, the kids’ school, and my classes. Balance has been the bigger journey.” Others had been through online programs themselves and therefore had more of a vision to follow when creating their virtual classes (e.g., Participant 3: “I actually went through a fully online program at [other] university. I wanted to understand more about online teaching.”). A few participants who already had course content that they could repurpose, especially videos, found that the transition was smoother than if they had needed to create all new content. Participant 1 has previously taught for a summer online undergraduate program, which required him to create lecture videos. Participant 1 mentioned that “I decided to take advantage of those classes . . . so while I had the videos and all I had to do is clip and edit.”

**What were the key challenges and lessons learned during the emergency transition?**

Our survey findings revealed that many faculty respondents encountered a range of challenges that were associated with the emergency move to online course delivery. More than three quarters of those who submitted their responses (total n = 243) reported that they had some issues related to the difficulty of remote teaching. Regarding the primary sources of issues, internet connectivity was most frequently reported (20%), technical issues outside their control was next (14%), followed by teaching equipment issues (12%). The remaining 30% chose “Other” sources of issues. Short answers were allowed as a follow-up, and we consolidated these optional responses by manually reading and coding them according to common themes. As a result, we identified four broad sources of issues: (1) instructional tools (e.g., more guidance or support needed) (28% within the “Other” category); (2) assignment and assessment (e.g., learning tasks do not fit the online mode) (26%); students (e.g., accessibility issues, different time zones, personal or emotional challenges) (29%); and (4) instructors’ own challenges due to time constraints and extra efforts (17%).

Yet, regarding the helpfulness of instructional resources to address such challenges (n = 249), a significant proportion of respondents rated support from their department/college (71%) and shared tips from other faculty (74%) as either “very helpful” or “somewhat helpful” (see Figure 3). Notably, many of the respondents (32%) never sought
webinars or other training opportunities, and only 35% of those who sought these resources found them helpful. These results suggest that faculty may benefit most from proactive support from within their department or college.

When we examined the faculty members’ perceived challenges in-depth through our case study, our findings were generally consistent with the survey results. As a result of our analysis, four themes emerged about faculty members’ perceived challenges while transitioning: lack of time with limited resources; difficulty of facilitating group projects or other collaborative learning activities; issues with rigor and fairness in assessment; and technical problems (see Appendix D for exemplary quotes). First, participants had to deal with a lack of time with limited resources as they were abruptly asked to switch to the remote mode during the second half of the semester. Many participants noted that they did not have enough time to plan or make changes to their liking, causing stress to some participants (e.g., Participant 6: “... it was psychological ... it felt like it took more time to change the classes”).

Second, participants commonly mentioned that they struggled with facilitating group projects or collaborative learning. For example, several participants mentioned that limited access to lab or studio facilities was a problem, especially for courses with “hands-on” learning components. As a result, they had to adjust their projects to accommodate for this situation, which often made it difficult to meet learning objectives as originally planned.

A third theme concerned challenges in ensuring both rigor and fairness in assessment of student learning remotely. Some participants noted that it was difficult to make accommodations for students who were in widely varying home environments while also keeping the class fair for everyone. For instance, Participant 1 administered all quizzes and tests synchronously during the class meeting time, which was 8am Eastern Standard Time. However, he had at least one student attending virtually from the West coast who complained that he had to wake up at 5am to take the exam. Likewise, Participant 2 mentioned “trying to find that balance between what’s fair to the rest of the class as a whole ... was hard.”

A fourth theme was related to dealing with technical issues or difficulties with using technology. Several participants brought up issues of internet connectivity and low bandwidth when it came to hosting live sessions for their classes. Additionally, small logistical
issues seemed to cause major difficulties in the online classroom. Some examples included using a whiteboard or doing a poll during live sessions (e.g., Participant 6: “It was a real pain to use the whiteboard . . . the way putting text on it or even drawing on it is really bad.”).

Despite dealing with various challenges associated with emergency remote teaching, our case study participants reported that they learned important lessons. Most participants mentioned gaining knowledge or insight on best practices for implementing online course design and activities in the future. When it comes to making decisions on delivering instruction remotely, several participants pointed out it would be helpful to have more discussion around comparing “the benefit of synchronous versus asynchronous mode.” In terms of course activities, many participants emphasized the need to increase “interactivity” between students and teacher, especially for large size classes in which students tend to be “detached.” Likewise, participants echoed the importance of nurturing “collaboration and team-work culture” even in a digital learning environment.

Another common theme that emerged across comments was the need to receive proactive support and resources from both the departmental and institutional levels. Although our participants, in general, seemed to find the institution’s emergency training useful to some extent, some sought more clarity on how to ensure “integrity and quality” remotely. Additionally, some participants noted that supportive departments made their transition experience easier. Still, other participants, especially those who taught more “hands-on” subjects such as design, stressed the demands for support from the school and institution to make equipment and materials “mobile and flexible” as well as to increase the “accessibility” and “visibility” of resources.

The last takeaway from participants’ remote teaching experience was the benefit of looking at the situation as an opportunity for learning. This emergency situation pushed all of our participants to experiment with technologies and modalities which many of them had been curious about but had not yet experienced. Despite the fact that the quick transition to remote teaching and learning involved a range of difficulties for the faculty participants, we observed that this transition process exemplified how agile and flexible they could be in adapting to the novel situation (e.g., Participant 4: “. . . you find a way to make it work, even it’s not ideal”). Ultimately, it seemed to allow the participants to rethink the future higher education model, or “a new hybrid model” moving forward.

**Discussion**

The results of our mixed-method study provide some practical implications for how faculty responded to the recent emergency move to remote teaching and what kinds of institutional support or resources should be recommended in the future remote delivery of courses. First, our combined findings from the online survey and case study suggested several factors played a key role in explaining the faculty’s negative perceptions toward the rapid transition to remote teaching. As Hodges et al. (2020) pointed out regarding the disruptive nature of emergency remote teaching, the transition process seemed to require significant adjustments and effort without giving faculty enough time to plan for remote course delivery. It may be that institutions need to be more flexible in the academic calendar to allow sufficient time for faculty to respond to emergencies effectively. Balancing this flexibility with factors such as faculty contracts and student progression toward graduation will be a complex task. Additionally, many of our participants felt that their course subjects and some of their initial face-to-face class activities
were not very suitable for online instruction, especially if those involved hands-on learning activities. It may be useful to provide faculty with a toolkit of instructional techniques that shows how certain types of in-person activities can be achieved online. Moreover, faculty could be encouraged to experiment with these techniques under “normal” conditions so that they are more ready to make these kinds of changes should the need arise in the future.

Also, as we observed different trends when disaggregating the survey responses by the college and discipline area (i.e., STEM versus non-STEM), our study findings implied that faculty might have varying needs depending on their college and school. Yet, these survey results should be interpreted with caution because it is possible that the respondents’ perceptions might vary depending on their prior online teaching experience, which was not captured in the survey. Moreover, as evidenced by clues in the results of the case study, it is worthwhile to note that faculty's remote teaching experiences might differ based on factors such as familiarity with technology, professional history, and home environment. Thus, it is recommended that the institution and individual colleges pay extra attention to assisting those faculty members who may have limited experience with online teaching and technologies to help them feel comfortable enough to deliver instruction remotely. Interestingly, at least for some time after the shift to emergency remote teaching it may be that most faculty will no longer fall into this category.

The results of this study provide insight into some key challenges and issues that arose during the transition to remote teaching. For our participants, the most challenging aspects of transition included engaging students in interactive learning activities as well as assessing students’ learning with the same perceived rigor and fairness that they would have had in an in-person class environment. Indeed, these areas of challenge have been identified as core elements in the ERTE framework (Whittle et al., 2020). Such challenges were often associated with the fact that faculty were expected to handle students’ increasing needs for accommodations. For example, students’ participation in remote learning tended to decrease due to various technical obstacles (e.g., limited access to Wi-Fi) and personal challenges (e.g., lack of time management skills, living in different time zones). Overall, these findings are generally consistent with the recently published reports on the impact of the pandemic on teaching and learning around the world (e.g., Bozkurt & Sharma, 2020; Marinoni et al., 2020; Pokhrel & Chhetri, 2021). At the same time, we go beyond extant research that heavily focused on data collected from survey instruments (e.g., Johnson et al., 2020; Safi et al., 2020) by providing more nuanced insight into what factors might lead some faculty to have positive transition experiences and others to have negative experiences based on the mixed-method study. In future emergency situations, educational institutions need to focus on providing structured guidance about instructional tools to enhance interactivity and effectively assess student learning online. Faculty would also benefit from having a broader toolkit of pedagogical and assessment techniques to draw from.

Finally, based on the lessons learned from this transition, our findings suggest that departmental guidance or peer advice appear to be more helpful than general forms of guidance (e.g., webinars, training). Thus, instructional support at the college or program level might be essential to address field-specific challenges in remote teaching. Given that faculty in our study seemed to benefit most from peer-coaching, it may be worthwhile to specifically train faculty in each subject area in this practice. Also, considering that the design of online instruction is highly dependent on which methods faculty use to deliver instruction (e.g., asynchronous, synchronous, mixed), the institution should provide the campus community with more clear guidance on which methods to choose and what would be the best practices for success. Most importantly, the institution needs to encourage the campus community to actively discuss what
the “hybrid” teaching model should look like in terms of course design, roles of faculty, and expectations for students moving forward. This will lead both faculty and staff to build innovative ideas to leverage evolving technologies and establish effective course delivery systems, or “digital pedagogy” (Tsai et al., 2020, p. 83).

We acknowledge several limitations of this study. First, because we were mainly interested in deepening understanding of the unprecedented phenomenon within a specific institutional context, there is limited generalizability of our findings to other institutional contexts. Second, due to the relatively small survey sample size, we found that the application of inferential statistics might not be feasible for conducting fine-grained cross-college comparisons, which warrants further research investigation. Third, although we were able to capture faculty voices that revealed nuanced experiences during the swift transition, our study provides only indirect or even biased information about how students reacted to remote learning through the lens of faculty. Future research should investigate the impact of emergency remote teaching from the perspective of students. Finally, our study findings reflect faculty perceptions during the relatively early stages of the pandemic. Considering the ongoing pandemic situation, it is difficult to understand, based on our findings alone, whether faculty perceptions toward remote teaching have changed over a much longer period.

**Conclusion**

In conclusion, our findings elucidate how the recent emergency move to remote teaching affected faculty’s perceptions and instructional practices. In terms of overcoming difficulties associated with the emergency transition, our study suggests that faculty could benefit most from proactive support and resources provided within their college or school, perhaps more so than university-wide resources. Moreover, our data suggests faculty’s willingness to experiment with new technology and view their remote teaching experience as a learning opportunity can help them better deal with the obstacles of remote teaching in the future. Our study also contributes to gaining insight into changing roles of faculty which traditionally emphasized on-campus teaching but increasingly requires competence in online teaching, a phenomenon sharply precipitated in response to the coronavirus pandemic. Building upon implications from this study, the next crucial step for higher education institutions and stakeholders would be to rethink “the hybrid model” of education for the post-pandemic era. The emergency move to remote teaching caused by the COVID-19 pandemic has opened the door for a new era of reflection on best practices in higher education.

**Disclosure statement**

The authors declare that they have no conflict of interest.

**Data Availability Statement**

Due to the nature of this research, participants of this study did not agree for their data to be shared publicly, so supporting data is not available.
Human Research Participants

This study includes human research participants. This study has been reviewed and approved by Georgia Institute of Technology’s Institutional Review Board (IRB) (protocol number: H20157). Informed consent was obtained from all individual participants included in the study.

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References

Appendices

Appendix A. Case Study Participant Demographic Description

<table>
<thead>
<tr>
<th>Participant</th>
<th>College/School</th>
<th>Rank/Title</th>
<th>Years of Teaching</th>
<th>Number of Courses Taught during Spring 2020 (Level)</th>
<th>Course Subjects (Class Size)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Engineering/Industrial and Systems Engineering</td>
<td>Professor of Practice</td>
<td>7 years</td>
<td>1 course with 2 classes (undergraduate level)</td>
<td>Statistics &amp; Applications (38 &amp; 76)</td>
</tr>
<tr>
<td>P2</td>
<td>Engineering/Aerospace Engineering</td>
<td>Lecturer</td>
<td>6 years</td>
<td>3 courses (undergraduate level)</td>
<td>Statistics (50), Introduction to AE (50), Technical communication for AE (100)</td>
</tr>
<tr>
<td>P3</td>
<td>Design/Building Construction</td>
<td>Professor of Practice</td>
<td>14 years</td>
<td>3 courses (master's level)</td>
<td>Real-estate production financing (12), real-estate development capstone (5), affordable housing (7)</td>
</tr>
<tr>
<td>P4</td>
<td>Design/Industrial Design</td>
<td>Assistant Professor</td>
<td>2 years</td>
<td>2 courses (one for undergraduate, another for master's level)</td>
<td>Industrial design studio 2 (for sophomores, 21 students), Crafting design (9)</td>
</tr>
<tr>
<td>P5</td>
<td>Sciences/Biological Sciences</td>
<td>Associate Professor</td>
<td>34 years</td>
<td>3 courses (undergraduate level)</td>
<td>Freshmen biology – biological principles (100), cell biology (100), immunology (50)</td>
</tr>
<tr>
<td>P6</td>
<td>Sciences/Biological Sciences</td>
<td>Assistant Professor</td>
<td>5 years</td>
<td>1 course (undergraduate level)</td>
<td>Evolution (78)</td>
</tr>
<tr>
<td>P7</td>
<td>Design/City &amp; Regional Planning, Architecture</td>
<td>Associate Professor</td>
<td>11 years</td>
<td>2 courses (master's level)</td>
<td>Urban design studio (7), Urban ecological design (20)</td>
</tr>
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</table>
Appendix B. Bivariate Correlations among Instructor and Perception Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
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</thead>
<tbody>
<tr>
<td>1. Tenure Track</td>
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<td>2. STEM</td>
<td>.08</td>
<td>1</td>
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<td>3. Years of Teaching</td>
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<td>.08</td>
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<tr>
<td>4. Class Count</td>
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<td>−.29</td>
<td>−.05</td>
<td>1</td>
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<td></td>
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<tr>
<td>5. Max Class Size</td>
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<td>.19</td>
<td>.05</td>
<td>.12</td>
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<td>6. Adjustment</td>
<td>−.14</td>
<td>−.12</td>
<td>−.07</td>
<td>.16</td>
<td>.15</td>
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<tr>
<td>7. Suitability</td>
<td>.11</td>
<td>.07</td>
<td>.07</td>
<td>−.06</td>
<td>−.04</td>
<td>−.20</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>8. Comfort</td>
<td>−.10</td>
<td>.05</td>
<td>−.07</td>
<td>.06</td>
<td>.08</td>
<td>−.15</td>
<td>.33</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Satisfaction</td>
<td>.08</td>
<td>.06</td>
<td>.03</td>
<td>.03</td>
<td>−.07</td>
<td>−.28</td>
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<td>.51</td>
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<tr>
<td>10. Perceived difficulty</td>
<td>−.13</td>
<td>−.16</td>
<td>−.06</td>
<td>.19</td>
<td>.12</td>
<td>.43</td>
<td>−.36</td>
<td>−.33</td>
<td>−.52</td>
<td>1</td>
</tr>
</tbody>
</table>

Class Count indicates the number of classes that faculty was currently teaching during Spring 2020. Max Class Size refers to the maximum number of students in their classes. * indicates $p < .05$ and ** $p < .01$.

Appendix C. Exemplary Quotes from Case Study Participants with Different Levels of Familiarity with Technology

<table>
<thead>
<tr>
<th>Levels of Familiarity</th>
<th>Example Comments</th>
</tr>
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</table>
| Higher                | • Participant 3: “I was actually glad to be challenged to take the step because I think that this is, you know, going to be a component of our program going forward, which is why I put the time in a few years back to go through the program.”  
  • Participant 5: “Delivering lectures online was not a problem because of having prior experience with having zoom meetings or running workshop sessions in the department.”  
  • Participant 7: “I think the purpose of education, urban design is for us is to simulate the actual practice in real world . . . those American large architecture firm, planning consulting firm, they constantly take project internationally. Like lots of firms run projects in China, India, Middle East, Africa, and they need to operate it, the work, remotely as well . . . They should work and we constantly meet digitally. I think that is a kind of a model that we, I think we fit into that practice very well . . . design education, studio moving from face-to-face to a digital learning environment . . . We have been successfully moving to that model.” |
| Lower                 | • Participant 4: “I have no experience teaching a design course online, and to be honest, that is because most design courses do not have online options. Although it went well, I do not think it would be how I would educate like people forever within design. Honestly, I hate teaching online . . . it’s so much more work. It takes more of my time and I do not enjoy it.”  
  • Participant 6: “Luckily enough [School of] Biology held “how do you use BlueJeans [a web conferencing tool]” . . . right before [the transition] . . . and I never actually used BlueJeans before. So I was just getting used to that and then running through tests . . . so it felt like it took more time to change the classes . . . especially it wasn’t the intent of the course.” |
### Appendix D. Challenges with Emergency Remote Teaching: Themes and Exemplary Quotes from Case Study Participants

<table>
<thead>
<tr>
<th>Themes Emerged</th>
<th>Exemplary Quotes</th>
</tr>
</thead>
</table>
| Lack of time with limited resources                                          | • Participant 3: “And so the exam review . . . I gave them the templates, and said, here is what you will use for the final exam . . . I couldn’t really deliver the information without being face-to-face with them and hearing their questions . . . I just didn’t have time to do that.”
• Participant 6: “Some of the issue was jump to the transition . . . it was psychological . . . it felt like it took more time to change the classes . . . because it wasn’t the intent of the course.” |
| Difficulty of facilitating group projects or other collaborative learning activities | • Participant 4: “The main point of that [studio-based group] project is . . . they were supposed to be making very quick prototypes and then bringing those prototypes to . . . expert users and have them look at it and test it and to make revisions based on that. And that of course quickly became not possible.”
• Participant 5: “It was difficult to engage the students to work in groups, um, certainly in a synchronous class session. I basically gave up on the small group, problem solving sessions. They basically individually worked on the problems. They rarely spoke to each other. They weren’t used to interacting with each other.”
• Participant 7: “[We] got a huge impact for COVID-19. . . . How do we nurture collaborative teamwork? Student would be able to learn from each other and for urban design in particular the project is complex.” |
| Issues with rigor and fairness in assessment                                  | • Participant 1: “I really struggled about that, but a decision had to be made and it was a tough decision because I had to balance the students’ care with protecting the integrity of a graded assessment. So it would be fair for all of my students.”
• Participant 2: “So trying to find that balance between what’s fair to the rest of the class as a whole, and you know, how do I kind of make sure that the student gets just enough learning to be able to justify passing them in the class . . . that was hard.” |
| Technical problems                                                            | • Participant 1: “I Googled stuff. I watched some YouTube videos, and then I actually didn’t trust that it worked.”
• Participant 2: “I’m trying to host live, you know, question and answer sessions. There are four of us in this house who are all on some sort of video chat . . . So we are definitely testing the limits of our own home internet, which isn’t great. We don’t live in a place that has great, you know, great connection.”
• Participant 6: “I recorded when I did the actual class, had some sort of question and answer. One time I forgot to record, which was like, ‘Oh crap, I gotta redo the lecture. . . . It was a real pain to use the whiteboard . . . the way putting text on it or even drawing on it is really bad.” |